

**PHOSPHATE ROCK**

(Data in thousand metric tons, unless otherwise noted)

**Domestic Production and Use:** Phosphate rock ore was mined by 11 firms in 4 States, and upgraded into an estimated 41.5 million tons of marketable product valued at \$1.21 billion, f.o.b. mine. Florida and North Carolina accounted for 85% of total domestic output, with the remainder produced in southeastern Idaho and northwestern Utah. About 90% of U.S. phosphate rock demand was for the conversion into wet-process phosphoric acid and superphosphoric acid, which were used as intermediates in the manufacture of granular and liquid ammonium phosphate fertilizers. More than 50% of the wet-process phosphoric acid produced was exported in the form of upgraded granular diammonium and monoammonium phosphate fertilizer, triple superphosphate fertilizer, and merchant grade phosphoric acid. Calcium phosphate animal feed supplements were manufactured from defluorinated phosphate rock and defluorinated phosphoric acid. Phosphate rock mined by two western companies was used as feedstock for elemental phosphorus production at two wholly owned electric furnace facilities in Idaho. Elemental phosphorus was used to produce high-purity phosphoric acid and phosphorus compounds, which were used in a variety of industrial applications.

**Salient Statistics—United States:**

	1995	1996	1997	1998	1999 <sup>a</sup>
Production <sup>1</sup>	43,500	45,400	45,900	44,200	41,500
Sold or used by producers	43,700	43,500	42,100	43,700	42,900
Imports for consumption	1,800	1,800	1,830	1,760	2,100
Exports	2,760	1,570	335	378	320
Consumption <sup>2</sup>	42,700	43,700	43,600	45,000	44,700
Price, average value, dollars per ton, f.o.b. mine <sup>3</sup>	21.75	23.40	24.40	25.46	29.12
Stocks, producer, yearend	5,710	6,390	7,910	7,920	6,800
Employment, mine and beneficiation plant, number	5,000	5,000	5,000	5,000	5,000
Net import reliance <sup>4</sup> as a percent of apparent consumption	E	—	—	3	7

**Recycling:** None.**Import Sources (1995-98):** Morocco, 99%; and other, 1%.

Tariff: Item	Number	Normal Trade Relations 12/31/99
Natural calcium phosphates:		
Unground	2510.10.0000	Free.
Ground	2510.20.0000	Free.

**Depletion Allowance:** 15% (Domestic and foreign).**Government Stockpile:** None.

**Events, Trends, and Issues:** In 1999, the domestic phosphate rock production decreased as producers in Florida reduced stocks and adjusted output to meet demand. Production in North Carolina was down owing to production difficulties, while Western mine production remained about the same as last year. Consumption of phosphate rock dropped slightly as fertilizer production slowed in the second half of the year. The largest phosphate producer permanently closed one of its six mines because of depleted reserves and temporarily closed two other mines to reduce existing stocks and prolong mine life. The company also continued with permitting procedures for two new mines that will be necessary to replace existing mines, which will be depleted of reserves within the next decade. Imports reached a record high because of an increase in production capacity at one fertilizer plant. Exports of phosphate rock have leveled after dropping significantly from 1995 to 1997.

Domestic consumption of phosphatic fertilizers was lower in 1999 primarily because of a reduction in the total acres of corn planted, which was caused by high stocks, low prices, and a reduction in Government assistance payments. Application rates for corn and other crops also were affected by wet weather in the Spring planting season. Exports sales of diammonium phosphate (DAP) remained about the same as last year, however shipments to India were delayed for several months because the Government was late in enacting fertilizer subsidies. Shipments of other fertilizers were lower than last year. The drop in demand early in the year resulted in high fertilizer stocks, primarily of DAP. In response to the weak market conditions and to reduce stocks, several phosphate fertilizer plants were closed temporarily in 1999. However, one DAP plant, which had been closed since 1992, reopened in Manatee County, FL.



## PHOSPHATE ROCK

New phosphate rock mines were commissioned in 1999 in Australia and Canada, thus eliminating the need for imports of phosphate rock in to the respective countries. New facilities in Australia, India, and Pakistan were anticipated to add 4.2 million tons of DAP capacity to that region over the next 2 years. This will have an impact on U.S. DAP exports, as the Indian subcontinent and Australia have been the second and third largest markets, respectively, for U.S. companies after China.

The increased need for world food production assures the long-term growth in world phosphate rock demand. The United States remains the world's largest producer and consumer of phosphate rock and the leader in fertilizer production and exports. U.S. mine production will likely decrease slightly in 2000, as producers reduce stocks and adjust output. U.S. producers will face greater international competition, as new production capacity for both phosphate rock and fertilizers will be added over the next several years. Domestic phosphate rock consumption was expected to decrease this year because of high grain and fertilizer stocks and projected decreases in total planted corn acreage. The export market will continue to be the determining factor for phosphate rock demand.

### World Mine Production, Reserves, and Reserve Base:

	Mine production		Reserves <sup>5</sup>	Reserve base <sup>5</sup>
	1998	1999 <sup>a</sup>		
United States	44,200	41,500	1,000,000	4,200,000
Brazil	4,270	4,500	330,000	370,000
China	25,000	20,000	500,000	1,200,000
Israel	4,100	4,100	180,000	180,000
Jordan	5,900	6,000	900,000	1,700,000
Morocco and Western Sahara	24,000	24,000	5,700,000	21,000,000
Russia	9,800	11,000	150,000	1,000,000
Senegal	1,300	1,600	50,000	160,000
South Africa	2,800	3,000	1,500,000	2,500,000
Syria	2,500	2,500	60,000	100,000
Togo	2,200	2,200	30,000	60,000
Tunisia	7,950	7,800	100,000	600,000
Other countries	<u>11,000</u>	<u>10,000</u>	<u>1,000,000</u>	<u>2,500,000</u>
World total (rounded)	145,000	138,000	12,000,000	36,000,000

**World Resources:** Phosphate rock resources occur principally as sedimentary marine phosphorites. Significant igneous occurrences are found in Canada, Russia, and South Africa. Large phosphate resources have been identified on the continental shelves and on seamounts in the Atlantic Ocean and the Pacific Ocean.

**Substitutes:** There are no substitutes for phosphorus in agriculture.

<sup>a</sup>Estimated. E Net exporter.

<sup>1</sup>Marketable.

<sup>2</sup>Defined as sold or used plus imports minus exports.

<sup>3</sup>Marketable phosphate rock, weighted value, all grades, domestic and export.

<sup>4</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>5</sup>See Appendix C for definitions.

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# **Strategic Assessment of Florida's Environment (SAFE)**

## **Acres of Phosphate Mining Lands Reclaimed**

### **Explanation of Indicator**

Florida is one of the world's largest producers of phosphate. Modern phosphate production is concentrated in central Florida, east of Tampa, where extensive deposits (covering approximately 1.3 million acres) of pebble phosphate are surface mined. Unfortunately, mining practices often destroy high quality habitat for wildlife.

Prior to July 1, 1975, more than 149,000 acres were mined and disturbed by phosphate operations. Approximately 60 percent of this land qualifies for reclamation funding through the state's non-mandatory reclamation program. State law, effective July 1, 1975, requires the reclamation (make suitable for beneficial use or habitat) of each individual acre of land that is mined pursuant to mandatory phosphate reclamation standards. These standards relate to safety, hydrology, contouring, revegetation, wildlife habitat and the timing of reclamation. Complete restoration (returning to original condition) is required only for wetland areas. Reclamation land uses include areas for recreation, pasturage, industry, homes, and wetland- wildlife sanctuaries.

There are two stages of reclamation: contouring and revegetation. Contouring is the stage in which the mined land is reshaped to resemble pre-mining topography and drainage. Revegetation provides for the replacement of native habitat and plant communities as well as for agricultural opportunities. Once reclamation has been satisfactorily completed in accordance with rules, the operator may be "released" from further obligation to perform reclamation.

### **Source**

Information may be obtained from Cheri Albin, Bureau of Mine Reclamation, FDEP, 2051 East Dirac Drive, Tallahassee, Florida 32310-3760, or (904) 488-8217.

### **Data Characteristics**

Since June, 1990 these data have been reported annually by mining sites throughout the state. Prior to June, 1990 these data were reported bi-annually. The information is available in hard copy format for associated copy costs.

### **Overall Assessment**

This is a good indicator because it provides the most accurate account of mined land that has been reclaimed. A limitation of this indicator is that it shows the quantity of land being reclaimed, not the quality of the reclaimed land. Changes in reporting technique may have caused previous estimates to be

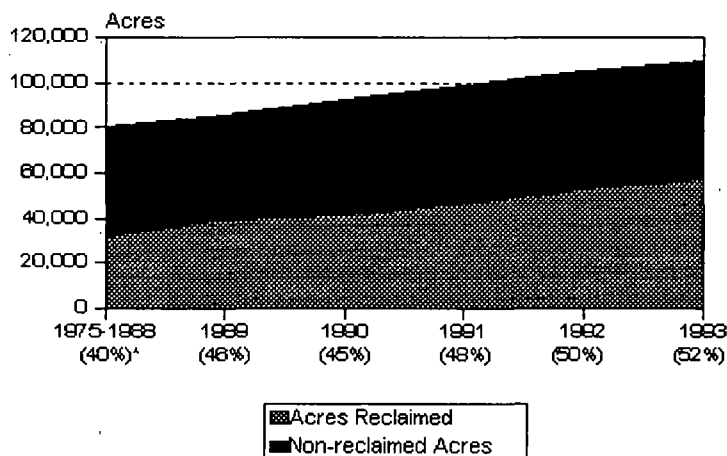
inaccurate, thus indicating a decline in acres mined when it was merely an adjustment of the figures.

### Analysis of Indicator

The total acres of land mined has continued to increase, indicating that phosphorus supplies are still plentiful. Since 1988 the number of acres mined has increased from 80,255 to 109,928 (as of December, 1993), a 37 percent increase. Since 1988 the number of acres reclaimed through contouring has increased from 21,200 to 28,944 acres, a 36.5 percent increase. During this period, 17,480 acres have been reclaimed and released. As of December, 1993, 52 percent of all mining land had been reclaimed.

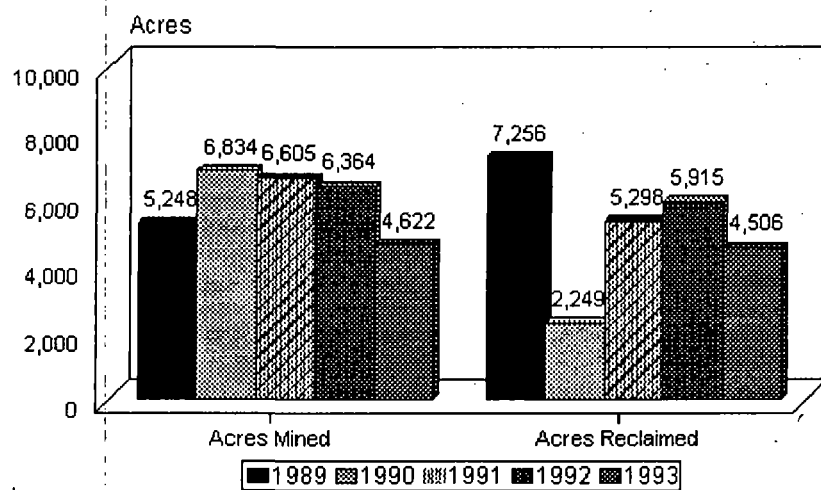
The second graph below represents the yearly changes in acres mined and reclaimed. This is distinguished from the previous data in that it represents the number of new acres mined and reclaimed on a yearly basis. For example, in 1989 5,248 acres were mined. This number is independent of the 7,256 acres which were reclaimed in that year. The number of new acres mined each year has slowly declined since 1990. This decline is due to overproduction in the industry and disruption of the world's phosphate systems. Since the phosphate industry is dictated by the market, declines in demand have led many companies to produce phosphate related products themselves in order to decrease the amount of phosphate rock exported. The acres of land reclaimed has fluctuated since 1989. It is not accurate to calculate percentages based on these yearly numbers since restoration is an on-going process, and obviously land that is being mined cannot be reclaimed at the same time.

Total Mined Acres Reclaimed



\*Percent of acres that have been reclaimed.

Acres Mined and Reclaimed Annually



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## Mining

### Mining

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- [Simplified DFP Flowsheet](#)
- [Aurora Operations](#)
- [White Springs Operations](#)

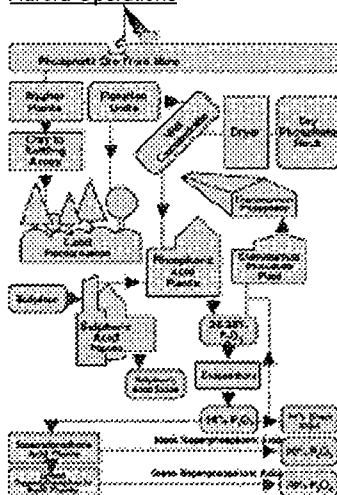
### Operations Products About Phosphate

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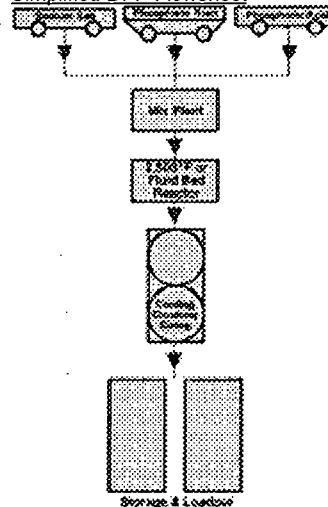
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PCS Phosphate mines deposits at one operation at Aurora, North Carolina, and one at White Springs, Florida, by uncovering and extracting them. Phosphate deposits can cover a great expanse. For example, PCS owns or controls over 22,000 acres in North Carolina and over 100,000 acres in Florida. The overburden, a covering of clay and sand, is removed by machine before the ore can be mined. It can be from seven to 32 meters deep. The phosphate bed itself is called the matrix and can be up to 12 meters in depth.

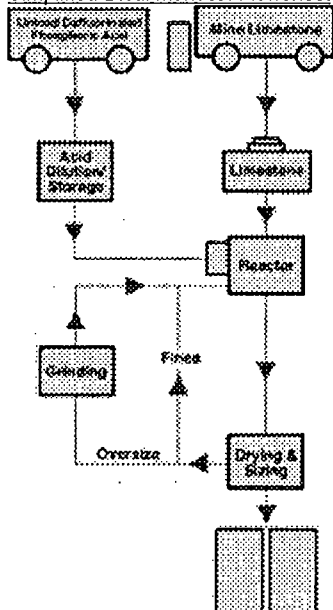
#### Aurora Operations



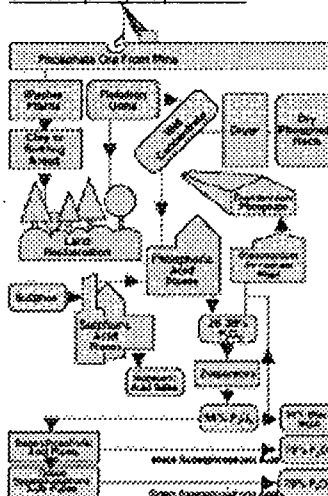
#### Simplified DFP Flowsheet



#### Simplified Dical/Monocal Flowsheet



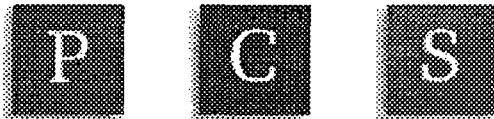
#### White Springs Operations





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## Stewardship

### Environment

#### PHOSPHATE Land Reclamation and Mitigation Projects White Springs

There are more than 35 individual land reclamation projects at the White Springs, Florida phosphate operations. These projects represent some of the most advanced reclamation technology. Generally these activities fall into the following categories:



Man-made lakes are stocked with fish native to the region.

#### Land and Lakes

These areas are made by reshaping the earth remaining from the mining operations. This is the fastest of the reclamation types, beginning almost immediately behind the mining equipment. Uplands, wetlands and open water areas can be created. Lake areas are quickly filled by an inflow of ground water as the water table is restored after mining and by rainfall runoff from adjacent uplands. A diversity of land forms results in a very productive fish and wildlife habitat. Potential land uses include residential, recreational, forestry and agricultural. Wetlands are built adjacent to the lakes using the naturally fluctuating water level of the lake to sustain the wetland.

#### Fill

These areas are created by filling the locations left by the removal of the phosphate ore with sand from the phosphate/sand/clay separation process. The remaining earth is



White Springs projects are a natural draw to many forms of wildlife.

then spread over the sand for topsoil. These areas are suitable essentially for agricultural use. Wetlands are created in these projects by leaving slight depressions in the fill. These wetlands are usually separated from streams or lakes, and are designed with sufficient natural water sources to maintain proper hydrology. Most of the mitigation projects for sensitive wetlands are built with this method.

#### Combined Alternative Standards/Land Acquisition

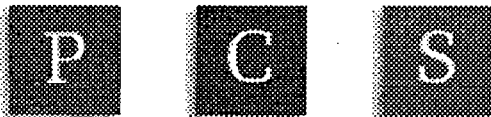
Many future reclamation and mitigation projects at the White Springs location will be based upon an innovative system developed in cooperation with federal, state and local governments. North Florida has a large natural area representing a unique opportunity for protection of valuable resources through the acquisition of lands for public ownership. In this system, White Springs is funding a program for acquisition of environmentally sensitive lands in the region. Reclamation projects in this system can be variants of each of the conventional reclamation types. Reclamation under alternate standards will continue to create environmentally and economically valuable land with significant benefits for recreation and wildlife. The land acquisition program is independently operated by partnership with government agencies and conservation organizations, which will be working together over the life of the operation to supplement and enhance environmental protection in the region through land acquisition. Projections estimate that up to 75,000 acres could be purchased through this type of program.

Through environmental initiatives at White Springs, people can enjoy their favorite recreational activities.

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## Stewardship

### Environment

#### PHOSPHATE Land Reclamation and Mitigation Projects Aurora

##### Project Area II

Project Area II is a created creek and marsh located between two tributaries of South Creek, which is a tributary of the Pamlico River in Beaufort County, North Carolina. The site was prepared by excavating and grading a wooded upland. Drainage channels were installed to simulate creeks. Approximately 50,000 plants were transplanted into the area in 1983 (7,000 smooth cordgrass, 7,000 saltmeadow cordgrass, and 36,000 big cordgrass).



Creeks meander through bushy areas that were once PCS Phosphate minesites.

##### Parker Farm Hardwood Wetland Restoration Site

In October 1994, PCS Phosphate purchased the 2,800-acre Parker Farm, which is primarily in the headwaters of South Creek in Beaufort County and extends into the headwaters of Vandemere Creek in Pamlico County, North Carolina. Approximately 2,000 acres of this farm are designated as prior-converted croplands. For 20 years prior to 1995, it had been cropped to corn, soybean and winter wheat.

The 2,000 acres were restored back to hardwood wetlands between 1995 and 1997. All field ditches were filled, major canals plugged, and 538 hardwood tree seedlings planted per acre. Twelve species were planted and included bald cypress, black gum, tupelo gum, green ash, overcup oak, swamp chestnut oak, willow oak, water oak, cherrybark oak, red maple, Atlantic white cedar and tulip poplar. As of September 1999, the U.S. Army Corps of Engineers determined that 1331 acres met success criteria to date, and are available for mitigation credit.

##### Bailey Creek Relocation

In 1996, PCS Phosphate relocated a portion of the headwaters of Bailey Creek, a tributary of South Creek in Beaufort County. This portion of the creek was channelized decades ago for agricultural drainage resulting in what was essentially a water-carrying canal, approximately 10 feet wide with vertical banks six to 12 feet deep in places.

The project involved relocation of 3,100 feet of the channel, or about three-fifths of a mile. The design provided for a 10-foot-wide channel about one to two feet in depth with a flat

floodplain extending about 50 feet on each side. This floodplain was designed so that water would rise out of the channel and flood the area during and after heavy rains. Meanders in the channel provided a natural-looking creek design. Approximately five acres of bottomland hardwood wetland forest were developed with 400 large wetland trees, six to 12 feet tall, and 2,000 one-year-old trees.

Bald cypress, green ash, various kinds of oaks, black gum, and river birch were among the species planted.

A birds-eye view of a PCS Phosphate reclamation project.